REMARKS

Claims 1, 3, 8, 30, 33, 34, 35, 39, and 40 have been amended. Claims 31, 36-38, and 41 were previously cancelled. Claims 1-30, 32-35, 39 and 40 are pending in the application. Applicant reserves the right to pursue the original claims and other claims in this and other applications.

Claims 1-5, 8-13, 30, 32-34, 39, and 40 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Harada (U.S. Pat. No. 7,133,072) in view of Bakhle et al. (U.S. Pat. No. 6,061,092), and further in view of Takayama et al. (U.S. Pat. No. 6,683,643). Claims 6, 7, 14, 15, 20-24, and 35 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Harada (U.S. Pat. No. 7,133,072) in view of Bakhle et al. (U.S. Pat. No. 6,061,092), further in view of Takayama et al. (U.S. Pat. No. 6,683,643), and still further in view of Houchin et al. (U.S. Pat. No. 5,047,861). Claims 16-19 and 25-29 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Harada (U.S. Pat. No. 7,133,072) in view of Bakhle et al. (U.S. Pat. No. 6,061,092), further in view of Takayama et al. (U.S. Pat. No. 6,683,643), still further in view of Houchin et al. (U.S. Pat. No. 5,047,861), and still further in view of Baharav (U.S. Pat. No. 6,737,625). The rejections are respectfully traversed and reconsideration is respectfully requested. Applicant notes that all obviousness rejections are dependent on the combination of Harada, Bakhle, and Takayama; if the combination of these three references can be overcome, additional references will not cure the deficiencies of the Harada, Bakhle, and Takayama combination.

The Office Action has failed to meet its burden of providing a *prima facie* showing of obviousness. The Supreme Court recently said in *KSR Int'l Co. v. Teleflex Inc.* that "the [Graham] factors continue to define the inquiry that controls" a finding of obviousness. 127 S. Ct. 1727, 1734 (U.S. 2007). The Graham factors include determining the scope and content of the prior art, ascertaining differences between the prior art and the claims at issue, and resolving the level of ordinary skill in the pertinent art. *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966).

Applicant submits that the Office Action has not properly shown that the Applicant's claims would have been obvious by conducting an examination of the Graham factors. *See*

M.P.E.P. § 2141 ("Patent examiners carry the responsibility of making sure that the standard of patentability enunciated by the Supreme Court and by the Congress is applied in each and every case."). Instead, the Office Action merely stated that it "would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the storing of gain and exposure time settings for the first and second data, as taught by Bakhle, with the compensation method of Harada[.]" Office Action at 5. This statement is not an adequate substitution for an analysis of the Graham factors and does not show obviousness.

Indeed, the Office Action admits that Harada "fails to specifically teach [that] the storage system stores a plurality of gain conditions and a plurality of exposure times associated with the first data and a plurality of gain conditions and a plurality of exposure times associated with the second data." *Id.* at 4. Additionally, the Office Action states that both Harada and Bakhle "fail to teach [that] the storage system stores data corresponding to both dark current reference images and white reference images", which the Office Action attempts to overcome by adding Takayama to the combination. However, the Office Action merely asserts that it "would have been obvious to one of ordinary skill in the art . . . to have incorporated the white reference images of Takayma with the storage of reference images based on gain and exposure time settings" to allegedly arrive at the claimed invention. *Id.* at 5. The Office Action does not offer any arguments for combining the three references. Instead, the Office Action's arguments are made with the benefit of hindsight. In fact, Bakhle teaches away from claim 1 in that it clearly states that because the camera is tethered to a host computer system such as a personal computer, it can take advantage of the storage and processing capabilities of the host. Bakhle, col. 3, ll. 40-44. Thus, Bakhle requires two separate components (i.e., a CMOS sensor-based digital video camera and a host computer system such as a personal computer (Bakhle, col. 3, ll. 38-42)). This is quite distinct from claim 1, which discloses an "image processing apparatus comprising: a storage system . . . [and] a processor." In other words, the disclosure of claim 1 does not rely on outside processing and storage capacity, as in Bakhle, but rather contains such capability in one apparatus. Based on this analysis, the Office Action has not applied the proper test for obviousness. Accordingly, the Office Action fails to make a *prima facie* case of obviousness. Without the benefit of hindsight, there would have been no

reason to modify Harada in view of Bakhle, and further in view of Takayama, and the Office Action has failed to provide proof of any such reasons.

Even assuming that the Office Action has met its burden of providing a *prima facie* showing of obviousness, which Applicant does not concede, the combination of Harada, Bakhle, and Takayama does not disclose, teach, or suggest, each element of the claimed invention.

Claim 1 recites an image processing apparatus comprising "a storage system for storing first data corresponding to at least one actual image and second data corresponding to at least one dark current reference image and at least one white reference image captured by a pixel array; ... a processor coupled to [the] storage system for compensating [the] first data using [the] second data, wherein [the] storage system stores a plurality of gain conditions and a plurality of exposure times associated with [the] first data and a plurality of gain conditions and a plurality of exposure times associated with [the] second data, wherein [the] second data enables identification and characterization of defective pixel signals from [the] at least one actual image based on at least one gain condition of [the] stored plurality of gain conditions and at least one exposure time of [the] stored plurality of exposure times, and wherein [the] processor selects and applies at least one defective pixel compensation method to [the] first data based on [the] characterization."

The present invention provides a method and apparatus for reducing the effects of dark current and defective pixels in imaging devices by capturing and storing dark and white reference images under varying conditions and later using those images to produce corrections for dark current and defective pixels when an actual image is acquired by the pixel array. U.S. Pat. Appl. No. 10/603,796 at pp. 3-4. The disclosure of Harada views the task of image correction as being carried out in two independent, yet inter-related, steps. First, there is Dark Correction. Dark Correction is applied to the *entire image* – except for those pixels which are selected to be corrected using Defect Correction (Harada, col. 5, ll. 58-61) – and is implemented after dark image data is captured from the CCD sensor which is shielded by a mechanical shutter under the same conditions as those upon sensing the object image. Harada, col. 5, ll. 50-55. Second, there is Defect

Correction. The defect correction circuit corrects any defects of pixels, which cannot be corrected by dark correction. Harada, col. 5, ll. 58-60. The determination of how much image correction is carried out using Defect Correction, and how much correction is carried out using Dark Correction is made based on the dark voltage while simultaneously considering some combination of the (a) temperature, (b) ISO speed, (c) and accumulation time parameters. Harada, col. 7, ll. 52-56. Based on the combination of this dark voltage with these three parameters a defect address instruction circuit looks up an optimal address table which provides the addresses of pixels which are deemed to be defective under the corresponding image sensing conditions. Harada, col. 7, ll. 40-55, col. 8, ll. 23-4.

Given this, Harada does not read disclose, teach, or suggest each element of claim 1. Harada does not "compensate[e] [the] first data using the second data," as recited in claim 1. The "second data" of Harada is not used to compensate the "first data," it is instead used to look up an optimal address table (Harada, col. 8, ll. 23-4) for pixels which are unable to be corrected merely by Dark Correction. Determination of which pixels will ultimately be corrected is not the same as using the "second data" to compensate the "first data" as recited in claim 1. Additionally, it is not the same as "select[ing] and apply[ing] at least one defective pixel compensation method to [the] first data based on [the defective pixel signal] characterization" as recited in claim 1. Harada explicitly states that "[t]he defect correction circuit corrects any defects of pixels, which cannot be corrected by dark correction, by interpolation using surrounding normal pixels." Harada, col. 5, ll. 58-61. Interpolation is a method of correction where pixels are corrected using the value of surrounding non-defective pixels. Harada discloses no alternative method for correcting the identified defective pixels. Without an alternative method there can be no selection amongst methods based on defective pixel characterization. Thus, Harada does not disclose, teach, or suggest "compensating [the] first data using [the] second data," nor "select[ing] and apply[ing] at least one defective pixel compensation method to [the] first data based on [the defective pixel signal] characterization" as recited in claim 1.

Additionally, Applicant respectfully submits that Harada fails to disclose that "[the] second data enables identification and characterization of defective pixel signals from [the] at least one actual image based on at least one gain condition of [the] stored plurality of gain conditions and at least one exposure time of [the] stored plurality of exposure times" as recited in claim 1. Harada discloses that a pixel which is to undergo defect correction is determined in accordance with at least one of the temperature, ISO speed, and accumulation time. Harada, col. 8, ll. 16-20. Harada does not disclose the use of gain or exposure times.

The Office Action has previously relied on Bakhle to teach that gain and exposure settings of the first image are stored in a storage system, and gain and exposure settings of a second image are also stored. However, based on the claims as currently amended, Applicant respectfully submits that Bakhle can no longer cure the deficiencies of Harada.

Bahkle discloses neither "second data [that] enables identification and characterization of defective pixel signals from [the] at least one actual image based on at least one gain condition of [the] stored plurality of gain conditions and at least one exposure time of [the] stored plurality of exposure times", nor a processor that "selects and applies at least one defective pixel compensation method to [the] first data based on [the] characterization" as recited in claim 1. The disclosure of Bakhle focuses on the correction of Dark Fixed Pattern Noise (DFPN) that results from photo-diode leakage current being sensed by the CMOS sensors. The correction of DFPN occurs at each pixel; it does not require the identification of specific locations within an image prior to the application of any correction. Bakhle, col. 1, ll. 26-32. This ability to conduct a wholesale "DFPN subtraction" allows Bakhle to disclose a method where the DFPN subtraction unit subtracts a currently applicable dark image from the sensed image to create a corrected sensed image. Bahkle, col. 4, ll. 13-16. Bakhle is distinct from the present application because it neither identifies specific locations within an image based on gain and exposure, nor does it have a processor select and apply a compensation method. Bahkle's disclosure uses only one compensation method where "[t]he DPFN subtraction unit subtracts a currently applicable dark image from the sensed image to create a corrected sensed image." *Id.*

As shown above, even if the references were combinable, which the Applicant does not concede, the references, alone or in combination, fail to disclose, teach, or suggest all elements of claim 1. For at least these reasons, Applicant respectfully submits that claim 1 is allowable over the cited references. Claims 2-7 depend from claim 1, and are allowable over Harada, Bakhle, and Takayama for at least the same reasons as independent claim 1, and on their own merit. Applicant respectfully requests that the rejections be withdrawn and the claims allowed.

Claim 8 recites a pixel compensation method comprising "capturing, using a pixel array, first data corresponding to at least one dark current reference image and at least one white reference image; storing reference data corresponding to [the] at least one dark current reference image and [the] at least one white reference image in a storage system, [the] storage system storing a plurality of gain conditions and a plurality of exposure times associated with [the] first data; capturing, using a pixel array, at least one actual image; storing second data corresponding to [the] at least one actual image in [the] storage system, [the] storage system storing a plurality of gain conditions and a plurality of exposure times associated with [the] second data; compensating [the] second data using [the] reference data to identify pixels requiring compensation of one defect, and compensating [the] second data using [the] reference data to identify pixels, if any, requiring compensation of multiple defects, wherein [the] compensation based on multiple types of defects includes a separate compensation method for each of [the] multiple types of defects."

Harada explicitly states that "[t]he defect correction circuit corrects any defects of pixels, which cannot be corrected by dark correction, by interpolation using surrounding normal pixels." Harada, col. 5, ll. 58-61. Interpolation is a method of correction where pixels are corrected using the value of surrounding non-defective pixels. Thus, Harada does not disclose, teach, or suggest "compensation based on multiple types of defects includ[ing] a separate compensation method for each of [the] multiple types of defects" as recited in claim 8. Harada neither categorizes defective pixels into different types, nor provides a separate compensation method for each type of defective pixel.

For at least these reasons, Applicant respectfully submits that Harada in view of Bakhle, and further in view of Takayama fails to disclose, teach, or suggest each and every limitation of claim 8. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claim 1, the Office Action has failed to meet its burden for showing a *prima facie* case of obviousness. Claims 9-29 depend from claim 8, and are allowable over Harada in view of Bakhle, and further in view of Takayama for at least the same reasons as independent claim 8, and on their own merit. Applicant respectfully requests that the rejections be withdrawn and the claims allowed.

Claim 30 recites a digital camera system comprising "an image sensor; a dark current and defective pixel compensation circuit for compensating first data corresponding to an actual image; and an image processor coupled to [the] dark current and defective pixel compensation circuit for forwarding [the] first data from [the] image sensor to [the] dark current and defective pixel compensation circuit, wherein the dark current and defective pixel compensation circuit includes a storage system, . . . [the] storage system storing a plurality of gain conditions and a plurality of exposure times associated with [the] first data and a plurality of gain conditions and a plurality of exposure times associated with [the] second data, wherein [the] second data enables identification of pixels of [the] first data which may be affected by at least one defect, and wherein [the] processor selects and applies a compensation method for each of [the] pixels for each of [the] at least one defect."

Harada explicitly states that "[t]he defect correction circuit corrects any defects of pixels, which cannot be corrected by dark correction, by interpolation using surrounding normal pixels." Harada, col. 5, ll. 58-61. Without an alternative method there can be no selection amongst compensation methods. Thus, Harada does not disclose, teach, or suggest "select[ion] and appli[cation of] a compensation method for each of [the] pixels for each of [the] at least one defect" as recited in claim 30. Harada neither categorizes defective pixels into different types, nor provides a separate compensation method for each type of defective pixel.

For the reasons set forth above, Applicant respectfully submits that Harada in view of Bakhle, and further in view of Takayama fails to disclose, teach, or suggest each and every limitation of claim 30. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claims 1 and 8, the Office Action has failed to meet its burden for showing a *prima facie* case of obviousness. Claim 32 depends from claim 30, and is allowable over Harada in view of Bakhle, and further in view of Takayama for at least the same reasons as independent claim 30, and on its own merit. Applicant respectfully requests that the rejections be withdrawn and the claims allowed.

Claim 33 recites a computer system comprising "a first processor; a memory device coupled to [the] processor via a bus; at least one input/output device, [the] at least one input/output device coupled to [the] processor via [the] peripheral bus, [the] input/output device being an imaging device; [the] imaging device further comprising: a storage system for storing first data . . . and at least one second processor coupled to [the] storage system for compensating [the] data corresponding to [the] actual image, wherein [the] second data enables identification and characterization of defective pixels of [the] first data which may be affected by at least one defect, [the] defective pixel being characterized as at least one of a dark dead pixel, a white dead pixel, a saturation dead pixel, or a bad pixel, and wherein [the] second processor selects and applies a defective pixel compensation method for each of [the] characterizations."

Harada explicitly states that "[t]he defect correction circuit corrects any defects of pixels, which cannot be corrected by dark correction, by interpolation using surrounding normal pixels." Harada, col. 5, ll. 58-61. Interpolation is a method of correction where pixels are corrected using the value of surrounding non-defective pixels. Thus, Harada does not disclose, teach, or suggest "[the] defective pixel being characterized as at least one of a dark dead pixel, a white dead pixel, a saturation dead pixel, or a bad pixel, and wherein [the] second processor selects and applies a defective pixel compensation method for each of [the] characterizations" as recited in claim 33.

Harada neither categorizes defective pixels into different types, nor provides a separate compensation method for each type of defective pixel.

For the reasons set forth above, Applicant respectfully submits that Harada in view of Bakhle, and further in view of Takayama fails to disclose, teach, or suggest each and every limitation of claim 33. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claims 1, 8 and 30, the Office Action has failed to meet its burden for showing a *prima facie* case of obviousness. Applicant respectfully request that the rejections be withdrawn and the claims allowed.

Claim 34 recites an image processing apparatus comprising "a storage system for storing first data corresponding to a plurality of actual images and second data corresponding to a plurality of dark current reference images and a plurality of white reference images captured by a pixel array; and a processor coupled to [the] storage system for compensating [the] first data using [the] second data, wherein [the] storage system stores a plurality of gain conditions and a plurality of exposure times associated with [the] first data and a plurality of gain conditions and a plurality of exposure times associated with [the] second data, wherein [the] second data enables identification and characterization of defective pixel signals from [the] at least one actual image based on at least one gain condition of [the] stored plurality of gain conditions and at least one exposure time of [the] stored plurality of exposure times, and wherein [the] processor selects and applies at least one defective pixel compensation method based on [the] characterization."

For the reasons set forth above with respect to claim 1, Applicant respectfully submits that Harada in view of Bakhle, and further in view of Takayama fails to disclose, teach, or suggest each and every limitation of claim 34. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claims 1, 8 30, and 33, the Office Action has

failed to meet its burden for showing a *prima facie* case of obviousness. Applicant respectfully requests that the rejections be withdrawn and the claims allowed.

Claim 35 recites an image processing apparatus comprising "a storage system for storing first data corresponding to at least one actual image and second data corresponding to at least one dark current reference image and at least one white reference image captured by a pixel array; and a processor coupled to [the] storage system for compensating [the] first data using [the] second data, wherein [the] storage system stores a plurality of gain conditions and a plurality of exposure times associated with [the] first data, [the] storage system further stores a plurality of gain conditions and a plurality of exposure times associated with [the] second data, and [the] storage system processor further stores light condition information for [the] second data, wherein [the] second data enables locating pixels requiring compensation based on one defect, and pixels requiring compensation based on multiple types of defects, and wherein [the] processor selects and applies a separate compensation method for each of [the] multiple types of defects."

Harada explicitly states that "[t]he defect correction circuit corrects any defects of pixels, which cannot be corrected by dark correction, by interpolation using surrounding normal pixels." Harada, col. 5, ll. 58-61. Without an alternative method of compensation there can be no separate compensation method for each of the types of defects. Thus, Harada does not disclose, teach, or suggest "a separate compensation method for each of [the] multiple types of defects" as recited in claim 35. Harada neither categorizes defective pixels into different types of defective pixels, nor provides a separate compensation method for each type of defective pixel.

For the reasons set forth above Applicant respectfully submits that Harada in view of Bakhle, further in view of Takayama, and still further in view of Houchin fails to disclose, teach, or suggest each and every limitation of claim 35. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claims 1, 8 30, 33 and 34, the

Office Action has failed to meet its burden for showing a *prima facie* case of obviousness. Applicant respectfully request that the rejections be withdrawn and the claims allowed.

Claim 39 recites a dark current and defective pixel compensation circuit comprising "at least one processor; a bus; and a storage system, coupled to [the] at least one processor via [the] bus, for storing first data corresponding to at least one actual image and second data corresponding to at least one dark current reference image and at least one white reference image captured by [the] image sensor, [the] storage system storing a plurality of gain conditions and a plurality of exposure times associated with [the] first data and a plurality of gain conditions and a plurality of exposure times associated with [the] second data, wherein [the] second data enables location of pixels of [the] first data which may be affected by at least one defect, and wherein [the] at least one processor identifies and applies a compensation method for each of [the] pixels for each of [the] at least one defects."

For the reasons set forth above with respect to claim 30, Applicant respectfully submits that Harada in view of Bakhle, and further in view of Takayama fails to disclose, teach, or suggest each and every limitation of claim 39. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claims 1, 8 30, 33, 34 and 35, the Office Action has failed to meet its burden for showing a *prima facie* case of obviousness. Applicant respectfully request that the rejections be withdrawn and the claims allowed.

Claim 40 recites an integrated circuit comprising "a dark current and defective pixel compensation circuit for compensating first data corresponding to an actual image; and an image processor coupled to [the] dark current and defective pixel compensation circuit for forwarding [the] first data from [the] image sensor to [the] dark current and defective pixel compensation circuit, wherein the dark current and defective pixel compensation circuit includes a storage system . . . [the] storage system storing a plurality of gain conditions and a plurality of exposure times associated with [the] first data and a plurality of gain conditions and a plurality of exposure times

associated with [the] second data, wherein [the] second data enables identification and characterization of defective pixels of [the] first data which may be affected by at least one defect, [the] defective pixel being characterized as at least one of a dark dead pixel, a white dead pixel, a saturation dead pixel, or a bad pixel, and wherein [the] second processor selects and applies a defective pixel compensation method for each of [the] characterizations."

For the reasons set forth above with respect to claim 33, Applicant respectfully submits that Harada in view of Bakhle, and further in view of Takayama fails to disclose, teach, or suggest each and every limitation of claim 40. Furthermore, even if the combination of the aforementioned references did teach all elements of the claim, which they do not, the references are not combinable. For all the reasons set forth above with respect to claims 1, 8 30, 33, 34, 35 and 39, the Office Action has failed to meet its burden for showing a *prima facie* case of obviousness. Applicant respectfully request that the rejections be withdrawn and the claims allowed.

In view of the above, Applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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